

Call for Proposals

FY 2023

Laboratory Directed Research and Development (LDRD) Program

I. Overview

The purpose of the LDRD program is to encourage innovation, creativity, originality, and quality to keep the Laboratory's research activities and staff at the forefront of science and technology.

The FY2023 LDRD program will have four funding tracks for proposals. Please note that these tracks are not in order of priority and are as follows:

- Lab-wide Initiative
- Multi-Area Topics
- Area-Priority
- Early Career Development

All proposals, including continuations, must be submitted through the online submission database located at <https://ldrd.lbl.gov/>.

II. FY23 Lab-wide Initiatives

*Please note – Only continuation proposals will be considered for Lab-wide Initiative Track funding in FY23. New proposals should not be submitted and will not be reviewed under this track.

Proposals in the Lab-wide Initiative track should foster the development of teams and activities in fields that directly support new, high level strategic goals of the Laboratory (<https://www.lbl.gov/programs/our-vision/>). The intent of this track is to ensure that appropriate review is provided for those topics of institutional strategic importance which cut across several Laboratory Areas. For this cycle, these proposals will be submitted in support of the following strategic initiative:

Carbon Negative Initiative (CNI): Previously titled "Negative Emissions Science and Technology (NEST)." We seek proposals to explore how Berkeley Lab could contribute to the grand challenge of removing greenhouse gases (GHGs) from the climate system via investigations into the scientific and technical foundations for Negative Emission Technologies (NETs). According to the Intergovernmental Panel on Climate Change, addressing global



warming will require rapid and widespread deployment of NETs to remove anthropogenic carbon dioxide and other GHGs from the climate system. This initiative will identify the most promising directions for future NETs research, leveraging the unique strengths of Berkeley Lab. Responsive proposals will act to: i) Identify and demonstrate the scientific foundations for new NETs, ii) Find pathways to accelerate and optimize promising NETs with high potential, and/or iii) Develop novel systems engineering approaches for capturing, handling, and storing carbon dioxide and it into biofuels, bioproducts, and biomaterials.

Initiative Topic	LDRD Lab-wide Initiative Review Lead(s)
Carbon Negative Initiative	Bill Collins

Principal Investigators (PIs) will indicate on their proposal submission that they wish to be reviewed via the Lab-wide Initiative funding track.

Criteria

All projects/proposals will be evaluated based both on their progress to date and continuing value of the following criteria: i) their alignment with the Lab’s strategic initiatives; ii) the quality of the proposed research; iii) the ability to leverage the unique cross-Area capabilities of the Laboratory; and iv) the uniqueness and novelty of the proposed project.

Review

Lab-wide Initiative projects/proposals will be reviewed in two rounds: First by a committee formed and managed by the Initiative Review Lead (see table above), and then by the Scientific Division Directors, Associate Laboratory Directors, and Senior Lab management.

The reviews will involve a combination of an evaluation of the written proposal and presentation(s) to a review team. The proposal text and presentation may be modified after the first round based on input from the review committee.

The LDRD Lab-wide Initiative Review Lead(s) will organize and manage the first round of reviews.

For the second round of reviews, the progress of the Lab-wide Initiative projects/proposals will be presented as a portfolio to a review committee of the Scientific Division Directors, Associate Laboratory Directors, and other Senior Lab management. For the second presentation, the Initiative Review Lead will be responsible for a coordinated presentation of the projects/proposals and may include one or more of the PIs.

Proposals that are considered scientifically competitive by the first review committee, but not well aligned with the Lab-wide Initiative track, will be automatically reviewed via the Area Initiative track.



III. FY23 Multi-Area Topics

In FY23 we are encouraging multi-Area LDRD proposals developing capabilities in general domains. The intent of this track is to encourage collaborations across Areas to work on projects in three topics:

- Automation in the Acquisition and Management of Experimental Data (Lab Automation)
- Data Science/Machine Learning to Accelerate Science
- Instrumentation to Advance Fundamental and Applied Science

Criteria and Detailed Track Guidance

In contrast with Lab-wide Initiative proposals, proposals submitted to this track are not intended to support a separate Lab-wide research initiative at LBNL. Instead, the intent is to support Laboratory research initiatives that are being pursued across Areas that incorporate one or more of the three topic areas. As such, criteria for these projects may be called out in advance in Area-priority descriptions below. The descriptions may differ in approach or division of work, so please make sure to read through them completely.

Proposals will be submitted by a lead Division/Area, usually the primary PI's Division/Area, with it being identified as multi-Area via a check box on the coversheet. In addition, co-PIs, other researchers, and their Areas should be explicitly identified in the appropriate coversheet data fields.

Lead and co-PIs are responsible for co-planning work and budgets for each partner Area with the assistance of those Area's resource analysts. These Area budgets should then be added together in a combined full proposal budget sheet. Both Area specific and total budget sheets should be uploaded into the submission database.

Funding will come from each of the researchers' home Area allocations with additional funds contributed by the Directorate reserve to support such projects. Funding splits will be determined on a project-by-project basis, depending on the technical contributions from each Area. The Directorate contribution will generally be limited to a maximum of \$100K, although higher levels of funding may be possible in exceptional circumstances. Buy-in, communication, participation, and financial support is required from all Areas involved in any one proposal for the proposal to receive the additional Directorate reserve funding.

Additional updates and instructions may follow in January at the discretion of the ALDs or Lab Directorate.

Review

Initial review and selection of the proposals and funding models for these proposals will be coordinated by the ALDs of the participating Areas after support determined at the Area level. The submitting ALDs will partner together to co-present this information during the final presentation to the Lab Director and Deputy Lab Director for Research for final selection and funding level decisions.



Lab Automation: We seek proposals that investigate, develop, and use technology to automate discovery science, including but not limited to self-driving labs incorporated through the next generation of advanced instrumentation and user facilities/centers at Berkeley Lab. Laboratories are not required to fit the classical definition, i.e. a room within a building, and may be expanded to alternative/non-typical settings, e.g. field observatories. The proposals may approach this from i) the fundamental stage: i.e. building out core level technologies and tools to assist with general lab automation, ii) the applied perspective: i.e. reimagining the application of lab automation tools to research, or iii) a combination of the two. For additional detailed information, please read the call outs in the Area-priority descriptions below.

Data Science and Machine Learning (DS/ML): We seek proposals that build on and extend innovative approaches to the management and use of datasets to extend our understanding of underlying science in areas of importance to Berkeley Lab. The proposals may approach this from i) the fundamental stage: i.e. developing core level algorithms and methods to enhance data science, analysis, and machine learning, ii) the applied perspective: i.e. applying or re-engineering existing DS/ML methods and techniques to solve applied problems in novel ways, or iii) a combination of the two. For additional detailed information, please read the call outs in the Area-priority descriptions below.

Instrumentation to Advance Fundamental and Applied Science: We seek proposals to develop innovative instrumentation in sensing, measurement, readout and data acquisition, etc. that will advance fundamental and/or applied scientific opportunities at Berkeley Lab. Multi-Area collaborations are encouraged in pursuit of advanced instrumentation to bring unique capabilities to bear on priority scientific research. Proposals may also include needed investments in technical infrastructure in support of instrumentation R&D.

IV. FY23 Area Priorities

Area-priority track proposals will be accepted in each of the scientific Areas of the Lab:

- Biosciences
- Computing Sciences
- Earth and Environmental Sciences
- Energy Sciences
- Energy Technologies
- Physical Sciences

Criteria

Area-priority proposals will be evaluated based on their novelty and scientific quality, as well as the ability to



introduce new research activities in areas important to one or more of the Scientific Divisions of the Lab. High-risk projects with the potential for significant scientific impact are strongly encouraged.

Proposals in this track can include researchers from more than one Area even if they are not targeting the multi-Area Topics listed above.

Review

The ALD and the Area-specific Division Directors will review the proposals in their Area; they may also include additional reviewers in the process. The PI will be involved in a single round of reviews involving the written proposal and follow-up to Area and Division management. The highly ranked Area Proposals will be presented by the relevant ALD or Division Director to the Lab Director and Deputy Lab Director for Research for final selection and funding level decisions.

The Area-priority LDRDs are encouraged in new “breakthrough” science areas. Within each Area, the particular research topics for which proposals are especially encouraged are:

Biosciences: i) Self-Driving Labs: Experimental and computational research and engineering to enable automated experimentation; ii) Carbon Smart Biomanufacturing: Research and development to efficiently use carbon as a feedstock (from biomass, waste, and/or gases) for biomanufacturing and/or biomanufacturing to develop net-neutral or net-negative products derived from carbon feedstocks; iii) Predictive Biology: Research and development of experimental and computational capabilities to enable accurate predictions of biological processes and phenomena, as well as possible interventions; iv) Computing, analysis, and data management: New approaches for biological computing, data analysis, and data management that meet FAIR principles, create standardized workflows, enable AI/ML, and organize data for future analysis; v) Emerging research: While the above topics represent strategic priorities for Biosciences and Berkeley Lab, proposals for emerging and nascent research topics of potential strategic interest for Biosciences are encouraged. Proposals for this topic area should propose research in an emerging research area.

Computing Sciences: i) New mathematical and statistical methods, including machine learning methods, that enable new capabilities in modeling, simulation, data analysis and control or steering of scientific instruments or energy systems; ii) Methods and systems to address complex data problems; iii) Techniques that explore new “superfacility” research challenges and develop use cases that integrate HPC, networking, and edge devices with experimental and observational facilities; iv) Architectures, programming frameworks and system software for resilience, security, productivity and performance on future architectures, including advanced microelectronics devices, quantum devices, and specialized architectures “at the edge”; or v) topics aligned with national and homeland security mission needs. New cross-Divisional and cross-Area partnerships are especially encouraged.



Earth and Environmental Sciences: i) Novel experimental and modeling approaches for subsurface properties and processes; ii) Advanced approaches to simulate soil-microbe-plant interactions across scales and in response to environmental stresses; and iii) Science, technologies, and machine learning to advance resilience, adaptation, and security of natural resources and the built environment

Energy Sciences: Proof-of-concept studies, driven by scientific opportunities in chemistry and materials, that develop new capabilities and/or transformational connections between core programs and user facilities, that integrate basic and applied research in novel ways, and/or that motivate long-term research and capabilities at the envisioned Charter Hill campus. These may include approaches to outstanding challenges in basic energy sciences that are not addressed by existing programs, that closely couple elements of theory, computation, synthesis and fabrication, and characterization, and that leverage data, artificial intelligence, machine learning, and/or robotics – for example, to enable automated and accelerated synthesis or understanding and control of materials phenomena and chemical transformations across multiple length and time scales. Concepts that have the potential to leverage the brightness and coherence of the upgraded ALS and emerging capabilities at the Molecular Foundry are also of particular interest. Proposals from single PIs and from multi-PI, cross-Divisional and cross-Area teams are encouraged.

Energy Technologies: i) Integrated Energy Systems: Develop spatiotemporal technologies and simulation tools to explain and engineer the dynamics of increasingly coupled energy systems (transportation, buildings, and industry) using the latest advances in computational, cybersecurity, economic and policy science; ii) Energy Storage Across Time and Length Scales: Novel concepts and foundational science for large-scale energy storage systems for stationary applications capable of >10 hours of discharge based on recent advances in chemistry and materials sciences with associated techno-economic and policy analysis; iii) Resilient Communities and Infrastructure: increase the resilience of the built environment through a focus on metrics, measurement, prediction and modeling, as well as scalable technologies and materials to be responsive to natural or health stressors; iv) Science of Manufacturing: enable a more circular economy through advances in chemical synthesis, materials science, and life-cycle assessment; v) Negative Emission Technologies: projects complementing this Lab-wide initiative; vi) Contributions within the above priorities aligned with national and homeland security mission needs are also encouraged; additionally in the FY23 call we are encouraging proposals on vii) Carbon Accounting: develop modeling capabilities for tracking and predicting flows of carbon dioxide over space and time in the evolving carbon economy, with a focus on the industrial sector, building sector, fossil fuels, and carbon sequestration, as well analyze the implications of embedded carbon in construction materials and the role carbon plays in Data Centers.

Physical Sciences: i) new scientific opportunities in particle physics and cosmology; ii) new opportunities in nuclear science; iii) advanced accelerator systems for colliders and other applications including high power lasers; iv) novel technical concepts and capabilities: especially microelectronics, semiconductor detectors, quantum



enabled technology, superconducting magnets; v) novel computing capabilities including AI/ML applied to particle physics, cosmology, nuclear science and accelerators; vi) new opportunities in fusion energy sciences; vii) leveraging LBNL capabilities to address national & homeland security mission needs, including monoenergetic photon sources, advanced neutron-based active interrogation concepts, and advanced radiation detection and imaging algorithms.

An important priority for the Physical Sciences Area is to establish the technical and theoretical capabilities for Berkeley Lab leadership roles in the scientific opportunities identified in the Nuclear Physics Long Range Plan, the High Energy Physics P5 report, and the Fusion Energy Sciences Long Range Plan, and to contribute to the upcoming strategic planning exercises in these areas. These opportunities include the Electron-Ion Collider (EIC) and its detectors, next generation high energy hadron and lepton colliders, next generation cosmic and dark matter surveys, high power lasers, superconducting magnet science and technology and other opportunities. Novel directions and high risk/high reward ideas are encouraged.

An Area-wide priority for FY23 is to support innovative ideas in instrumentation, with an emphasis on detector and readout R&D that could enable scientific opportunities in more than one discipline, with participation of multiple Divisions to create synergies across and outside the Area. Proposals may also include needed investments in technical infrastructure in support of instrumentation R&D.

V. FY23 Early Career Development

The intent of the Early Career Development (ECD) track is to develop the future scientific workforce and prepare early career PIs for a successful scientific career. An ECD LDRD grant is intended to be a first opportunity for an early career scientist to develop a PI experience at a national lab, which may include preparing for a DOE Early Career Grant application. Considering the future scientific workforce of Berkeley Lab, it is a goal of the laboratory to develop a diverse group of early career scientists and applications from underrepresented and other employee groups are very much encouraged. A maximum funding amount of \$450,000 per PI will be allocated for the entirety of the project. Starting with the FY23 cohort, the option exists for a funding model will be for up to \$150,000 per year for three fiscal years rather than split between two fiscal years. Any PI who is a member of the FY22 cohort or earlier should stay consistent with the funding model that they have previously executed under. The FY23 proposal request should reflect only the amount being requested for that specific fiscal year.

Criteria

PIs must have received their Ph.D. no earlier than January 1, 2014. Current postdocs can submit proposals, but, if successfully funded, they must be on track to a scientific job title (career or career track, research scientist or staff scientist) before the project starts. Candidates are also expected to go through a suitable search prior to the job title change to encourage their long-term growth and stability at the Lab.



An EC LDRD project must include effort for the PI, at no more than 50% of the PI's overall time. While the topic of the proposed project should be consistent with the Area strategy and create a strong basis for a future DOE Early Career grant application or other high value funding opportunities, it is expected that the Early Career LDRD project will be independent from and carried out in parallel to other assigned work from their home Divisions.

Please direct any further questions or inquiries about eligibility to your Division Director or ALD.

Review

Applying for this LDRD award invites early career scientists to start thinking strategically about their long-term plans and how these plans fit into the program goals of the Lab and the DOE. Thus, the ALD and the Area-specific Division Directors should encourage and mentor outstanding early career scientists to become ECD PIs in their Area, paying particular attention to diversity and inclusion. Ongoing mentorship by the Area or Division management will be essential for the success of the ECD PIs, thus ALDs/Division Directors should also prepare a mentoring plan for the PIs, and a mentoring plan should be submitted with the application.

ALDs and Division Directors will review the ECD proposals in their Area; they may also include additional reviewers in the process. The ECD PIs will be involved in a review process involving the written proposal and possibly a presentation to Area and Division management. Each ALD will forward the top ECD Proposal from their Area.

The selected ECD proposals from all Areas will then be presented by their PIs to the Lab Director, Deputy Lab Director, and all ALDs.

VI. General Proposal Requirements and Review Process

Proposals must include a:

- Cover Sheet
- Technical proposal (as described below)
- Budget Request form
- NEPA/CEQA form
- Human Subject and Animal Use form
- Intellectual Property forms

The technical proposal uploads for Lab-wide, Area-Priority, and Early Career Development tracks may not exceed a maximum of three pages of text with one additional page for figures and references. An additional fifth page will be allowed for Multi-Area track proposals to account for an extra page of text. Continuing project proposals must include within the page limit a statement of progress to date, detailed scope and deliverables for the current fiscal year, as well as prospects for follow-on funding.



Proposed work cannot supplement existing DOE projects, nor can it contain construction line items or maintenance activities. The expected duration of projects started in FY23 should target two years, with a third year available in outstanding and exemplary circumstances. However, second year funding is not guaranteed and will be based on several factors including progress towards goals and successful stewardship of project funding.

Proposals should be prepared carefully following the given specifications and requirements available online at Detailed Proposal Guidance.

Budget

Budgets must include payroll burden, procurement burden and support burden, if applicable, along with scientific organization burden. A Site Support overhead estimate should be included as a separate line item if applicable.

VII. Schedule and Support

The nominal schedule for the FY 2023 cycle is posted - see LDRD Review Schedule below. Final detailed scheduling of the review period and any presentations will be arranged by the ALD and/or Lab Director's offices.

Investigators should work with their Divisional or Area support staff to prepare their LDRD proposals. Administrative questions on LDRD may be addressed to Darren Ho (dho@lbl.gov).

For additional information about the purpose and implementation of the LDRD program at Berkeley Lab, please click this link: http://www.lbl.gov/DIR/assets/docs/LDRD_Guidelines_10-09-c.pdf

Information about the Laboratory LDRD proposal submission and review process can be found at: <http://www.lbl.gov/DIR/LDRD/cfp/process.html>



FY 2023 Laboratory Directed R&D (LDRD) Proposal Schedule

Schedule as of December 20, 2021. For any updates, please go to: <http://www.lbl.gov/DIR/LDRD/cfp/schedule.html>

Before January 1, 2022	Director issues Call for Proposals and guidance for FY 2023 LDRD to ALDs, Division Directors, and staff scientists via e-mail and Elements.
March 25, 2022	Principal investigators submit and lock FY 2023 LDRD proposals in the web-based submission system for Division processing. Associate Laboratory Directors (ALDs) initiate review processes of all proposals from their Area.
April 22, 2022	ALDs identify proposals selected for multi-Area and Early Career Development track review.
May 9-10, 2022	Presentation and Review Meetings for FY 2023 ECD, Lab-wide Initiative, multi-Area, and Area/Divisional Priority proposals.
July 1, 2022	Director or Deputy Director for Research notifies ALDs and Division Directors of preliminary FY 2023 awards.
September 1, 2022	LDRD Office notifies successfully awarded FY 2023 PIs. Project concurrence requests are provided to DOE-Berkeley Site Office (BSO).
October 1, 2022	DOE project concurrence is provided, and LDRD projects begin work.
December 16, 2022	Awards announced in Elements after final allocations are made.